REMARKS

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have amended each of claims 1 and 18, the only independent claims in the application, to incorporate in each the subject matter of both claims 3 and 5, and to recite that at least one of R_1, R_2, R_3 and R_4 of the formula [1] is not hydrogen. Note, e.g., Example 2 beginning on page 42 of Applicants' specification; see also Examples 6, 9 and 13 beginning respectively on pages 60, 67 and 80 of Applicants' specification. In light of amendments to claim 1, Applicants have cancelled claims 3 and 5 without prejudice or disclaimer, and amended dependency of claims 6 and 25. Moreover, Applicants have amended the subject matter of claim 5 being incorporated into claim 1, and have amended claims 6 and 25, to clarify which "R_1, R_2, R_3 and R_4" is being referenced, that is, the R_1, R_2, R_3 and R_4 of the compound of formula [1], or the R_1, R_2, R_3 and R_4 of the compounds represented by formulas [2] to [16]. Applicants have also amended claim 4 in light of amendments to claim 1, and have further amended claim 18 to correct a typographical error therein. Applicants have amended claim 26 to recite that the alignment control ability "of" the alignment control film is "promoted and stabilized by heating, irradiation of infrared rays, irradiation of far infrared rays, irradiation of electron beams or irradiation of radioactive rays to the alignment control film; note, for example, page 35, lines 2-5, of Applicants' specification.

The rejection of claim 26 under the second paragraph of 35 USC 112, set forth in Item 3 on page 5 of the Office Action mailed June 22, 2009, is noted. Claim 26 now recites that the alignment control ability is "promoted and stabilized" by the recited processing; it is respectfully submitted that the recitation in claim 26 is not

inconsistent with claim 1, reciting that the at least one of the alignment control films is an alignment control film of a specified material "provided with an alignment control ability by irradiation of specified substantially linearly polarized light", so that claim 26 is not vague in light of the irradiation recited in claim 1.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the reference applied by the Examiner in rejecting claims in the Office Action mailed June 22, 2009, that is, the teachings of U.S. Patent Application Publication No. 2001/0048498 to Tomioka, et al., under the provisions of 35 USC 102 and 35 USC 103.

It is respectfully submitted that this reference as applied by the Examiner would have neither taught nor would have suggested such a liquid crystal display, or such method as producing a liquid crystal display, as in the present claims, including producing/including the alignment control film comprising photoreactive polyimide and/or polyamic acid provided with an alignment control ability by irradiation of substantially linearly polarized light, with the photoreactive alignment control film containing polyamic acid or polyimide comprising cyclobutanetetracarboxylic acid dianhydride and/or its derivative and aromatic diamine, such dianhydride and/or its derivative being a compound represented by the formula [1], wherein R_1, R_2, R_3 and R_4 of the compound of formula [1] represent a hydrogen atom, a fluorine atom, an alkyl group or alkoxyl group with a carbon number of 1-6, with the proviso that at least one of R_1, R_2, R_3 and R_4 of this compound of formula [1] is not hydrogen. See claim 1. Note also claim 18.

That is, in claims 1 and 18 as now presented, at least one of R_1, R_2, R_3 and R_4 is not hydrogen (that is, is one of the other substituents recited in claim 1). In

contrast, and as will be discussed in more detail infra, the anhydrides forming the material of the alignment layer in Tomioka, et al. include 1,2,3,4-cyclobutane-tetracarboxylic acid anhydride, wherein each and every one of R_1, R_2, R_3 and R_4 is a hydrogen atom, clearly different from the presently claimed structure, wherein the formula [1] excludes the case that all of R_1, R_2, R_3 and R_4 represent a hydrogen atom. Thus, it is respectfully submitted that Tomioka, et al. would have neither taught nor would have suggested, and in fact would have taught away from, the subject matter of the present claims, including, inter alia, the group of cyclobutanetetracarboxylic acid dianhydride and/or its derivatives, included in the polyamic acid or polyimide contained in the photoreactive alignment control film.

In addition, it is respectfully submitted that the teachings of the applied reference would have neither disclosed nor would have suggested such liquid crystal display as in the present claims, having features as discussed previously in connection with claim 1, and, additionally, wherein the aromatic diamine compound included in the polyamic acid or polyimide contained in the photoreactive alignment control film is selected from the group of compounds represented by formulas [2]-[16] as in claim 6; and/or wherein the cyclobutanetetracarboxylic acid dianhydride and/or its derivative is a compound as set forth in claim 25, wherein R_1, R_2 of the compound represented by formula [1] each represent a fluorine atom, an alkyl group or alkoxyl group with a carbon number of 1-6.

Furthermore, it is respectfully submitted that this reference as applied by the Examiner would have neither disclosed nor would have suggested other features of the present invention as in the other rejected claims in the application, having features of claim 1 as discussed previously, and, moreover, wherein an alignment direction of the liquid crystal molecules of the liquid crystal layer on a surface of the

alignment control film is in parallel with or orthogonal to a polarization axis of the substantially linearly polarized light for irradiation (see claim 2); and/or the more specific definition of the material of the photoreactive alignment control film as in claim 4; and/or thickness of the alignment control film including the polyimide material, as in claim 7 or as in claim 8.

In addition, it is respectfully submitted that the teachings of the applied reference would have neither disclosed nor would have suggested such liquid crystal display as in the present claims, having features as discussed previously in connection with claim 1, and wherein the group of electrodes formed on one of the pair of substrates of the display, and configured so as to apply an electric field having a component substantially in parallel with a surface of the one of the pair of substrates to the liquid crystal layer, has electrode structure as in claim 12, of material as in claims 13 and 14; and/or wherein the electrodes are disposed in parallel with each other and each have a bending structure (see claim 15); and/or wherein at least one of the electrodes, that is, the common electrode and/or pixel electrode, is formed on an organic insulating film, with the liquid crystal alignment film being formed on the organic insulating film and the group of electrodes (see claim 16).

Furthermore, it is respectfully submitted that the teachings of these applied references would have neither disclosed nor would have suggested such display as in the present claims, having the electrodes and alignment control films as discussed previously, and wherein the liquid crystal molecules have substantially the same alignment control directions at two interfaces between the liquid crystal layer and the alignment control film formed on each of the paired substrates (see claim 17); and/or

wherein the alignment control ability of the alignment control film is promoted and stabilized by the processing procedures as recited in claim 26.

The invention as claimed in the above-identified application is directed to a liquid crystal display and method of fabrication thereof, in particular, wherein such liquid crystal display has an In-Plane Switching (IPS) scheme in which an electric field substantially in parallel with a substrate is applied to a liquid crystal layer for operation.

An IPS scheme is one in which inter-digital electrodes formed on one of a pair of substrates are used to produce an electric field having a component substantially in parallel with the substrate surface, to rotate liquid crystal molecules constituting a liquid crystal layer in a plane substantially in parallel with the substrate, and the birefringence of the liquid crystal layer is used to realize the display.

However, with liquid crystal displays of the IPS scheme, particularly with large-screen displays, wherein such display has many stepped structures on a surface opposite to a liquid crystal layer, it is difficult to perform uniform alignment processing on an alignment control film over a large screen.

As described in the paragraph bridging pages 8 and 9 of Applicants' specification, the uniformity of alignment is a very important factor in the IPS scheme, and problems in the currently used rubbing technique have become apparent. In order to avoid these problems in connection with rubbing alignment processing, a so-called "rubbing-less" alignment technique for aligning the liquid crystal molecules without the rubbing has been studied, and various processes thereof have been proposed. Among such various processes, a process has been proposed in which polarized ultraviolet rays or the like are irradiated to the surface of a polymer film to align liquid crystal molecules without the rubbing. As material of

liquid crystal alignment films aligned without rubbing, use of a polymer compound having a photoreactive group in a side chain of the polymer has been proposed, to provide photochemical sensitivity to polarized light. Another proposal involves dispersing low-molecular dichroic azole dye in a polymer material and irradiating a film surface with polarized light to allow the alignment of liquid crystal molecules in a predetermined direction. In addition, alignment of liquid crystal molecules achieved by irradiating a particular polyimide film with polarized ultraviolet rays or the like has been reported.

However, none of the proposed techniques have been satisfactory, and involve various problems from a practical standpoint. That is, heat stability of the alignment can be insufficient, and satisfactory reliability is not ensured. Moreover, when dispersing a dichroic dye in the polymer, the dye being included for aligning the liquid crystal, problems remain in terms of reliability for heat and light. Note also additional problems as described in the paragraph bridging pages 11 and 12 of Applicants' specification.

Thus, problems remain with respect to use of previously proposed materials, in connection with thermal stability and sufficiency in the alignment property, as well as being capable of mass production.

Applicants overcome these problems and achieve objectives according to the present invention, through use of the alignment control film according to the present invention. Specifically, Applicants have found that through use of an alignment control film which is a photoreactive alignment control film containing polyamic acid or polyimide including cyclobutanetetracarboxylic acid dianhydride and/or its derivative and aromatic diamine, the cyclobutanetetracarboxylic acid dianhydride and/or its derivative being a compound represented by the formula [1] as in the

present claims, objectives according to the present invention are achieved. Such objectives are further achieved wherein the aromatic diamine is at least one selected from the group of compounds consisting of compounds represented by the formulas [2]-[16] in the present claims. Through use of the alignment control film as in the present claims, especially in the liquid crystal display of the IPS scheme, stable liquid crystal alignment, which display can be provided with excellent mass productivity, and wherein the image quality has a higher contrast ratio, can be achieved.

Effects of the present invention are further achieved wherein the alignment control film is formed as a thin film having a thickness from 1 nm-100 nm, with light transmittance being improved and the efficiency of light reaction with polarized light irradiation being effectively improved. Furthermore, when the alignment control film on the electrodes is formed as a thin film having a thickness from 1-50 nm, it is possible to reduce a direct current voltage component remaining between the electrode/alignment control film/liquid crystal layer/alignment control film/electrode in each pixel of the liquid crystal display, and after-image and persistence characteristics are effectively enhanced. Note the sole full paragraph on page 18 of Applicants' specification.

As for additional features of the present invention as in the present claims, and advantages thereof, note, for example, from page 18, line 19, through page 21, line 8, of Applicants' specification.

Tomioka, et al. discloses an active matrix liquid display device, having pixel electrodes and common electrodes and active elements arranged on at least one substrate, with liquid crystal of the liquid crystal layer being controlled to provide the display by applying a voltage between the pixel electrode and the common

electrode, and with a pair of alignment layers individually formed on surfaces in contact with the liquid crystal layer of the pair of substrates, the alignment layers being made of an organic polymer of polyamic acid group or "polymamide" ester group having a relative imidization ratio above 60%. Note, in particular, paragraphs [0015]-[0018] on page 2 of this patent document. Note also paragraphs [0032] and [0033] of this patent document, disclosing that the alignment layer is made of an organic polymer of dehydration ring closure of polyamic acid composed of diamine compounds and tetracarboxylic acid anhydride. Note also paragraph [0064] on page 5 of this patent document. See also paragraphs [0074] and [0076] on pages 6 and 7 of this patent document, respectively disclosing diamine and acid components of composition material of the alignment layer. Note also paragraph [0080] on page 7 of this patent document, disclosing that it is possible to use a photo-reactive alignment layer which is processed through polarization light irradiation treatment so as to selectively cause photochemical reaction. See also paragraph [0177] on page 16 of this patent document, wherein, in Embodied Example 8, there is disclosure of a polyamic acid varnish composed of 4,4'-diamino-diphenylmethane as the diamine chemical compound and 1,2,3,4-cyclobutane-tetracarboxylic acid anhydride as the acid anhydride, the polyamic acid varnish being cured and imidized; and that, after that, photoalignment treatment was performed by irradiating linearly polarized light of 313 nm wavelength onto the surface.

Note that in the above-described Embodied Example 8, the dianhydride component is 1,2,3,4-cyclobutane-tetracarboxylic acid anhydride. In this dianhydride where corresponding to formula [1] of Applicants' disclosure, each of R_1, R_2, R_3 and R_4 represents a hydrogen atom. It is respectfully submitted that this patent

document does not disclose, nor would have suggested, such alignment control film as in the present claims, including wherein the cyclobutanetetracarboxylic acid dianhydride and/or its derivative is a compound represented by the formula [1] as in present claim 1, with the proviso that at least one of R_1, R_2, R_3 and R_4 of the compound of formula [1] is not hydrogen.

Additionally, in Embodied Example 8 of Tomioka, et al. the diamine component for forming the alignment layer is 4,4'-diamino-diphenylmethane. It is respectfully submitted that this compound, relative to formula [5] in claim 6, has X representing a hydrogen atom in the formula [5]. It is respectfully submitted that this reference also would have neither disclosed nor would have suggested, and in fact would have taught away from, such photoreactive alignment control film as in the present claims, formed using an aromatic diamine as in claim 6, including wherein X represents a bond group -S-, -CO-, -NH-.

While the Examiner, in the paragraph bridging pages 4 and 5 of the Office Action mailed June 22, 2009, refers to components of the polyamic acid varnish in Embodied Example 8, as can be seen in the foregoing such components are each outside the scope of the present claims; and it is respectfully submitted that the polyamic acid varnish in Embodied Example 8 in Tomioka, et al. would have neither disclosed nor would have suggested, and in fact would have taught away from, the alignment control film of the present claims.

Attention is particularly directed to claim 25, with respect to the teachings of Tomioka, et al. That is, claim 25 recites that R_1 and R_4 in formula [1] represent a fluorine atom, an alkyl group or alkoxyl group with a carbon number of 1-6. The display including the alignment control film as in claim 25, further distanced from the teachings of Tomioka, et al., as compared with the subject matter of claim 1, would

have neither been taught nor would have been suggested by the teachings of Tomioka, et al.

Indication of allowable subject matter in claims 9-11 and 19-24, as set forth in Item 4 on page 5 of the Office Action mailed June 22, 2009, is noted with thanks. In view of the foregoing, it is respectfully submitted that all of the present claims, including parent/independent claims upon which claims 9-11 and 19-24 ultimately depend, should also be allowed; and it is respectfully submitted that claims 9-11 and 19-24 need not be set forth in independent form in order to be allowable.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims presently pending in the above-identified application are respectfully requested.

To the extent necessary, Applicants hereby petition for an extension of time under 37 CFR 1.136. Kindly charge any shortage of fees due in connection with the filing of this paper, including any extension of time fees, to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Account No. 01-2135 (case 500.45133X00), and please credit any overpayments to such Deposit Account.

Respectfully submitted,

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